The Centralization of Operations and Access to Treatment: Total Hip Replacement in Manitoba

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Abstract: The impact of centralized facilities on access to care was tested by studying total hip arthroplasty in the Province of Manitoba, Canada. Data from the Manitoba Health Services Commission, which insures costs of all medical services in the Province, show that the availability of this surgical procedure has increased steadily over the 1973–78 period at a rate similar to that elsewhere in North America. Although Manitoba's population is geographically dispersed, specialized orthopedic services are concentrated in two urban centers. No important difference in access to care for this condition was found between urban center residents and residents distant from the surgical facilities. (*Am J Public Health* 1985; 75:130–133.)

There is a growing concern that low volume surgery may be associated with poor outcomes. Both mortality (of high-risk procedures) and post-operative complications have been shown to be higher in hospitals doing few procedures.[1–3] Total hip replacement has been one of those procedures recommended as a candidate for early centralization.[1]

Opponents of centralization have focused on the disruption of physician practice patterns, particularly upon the barriers which such centralization may place on patients' access to care. It is not known how well referral patterns work when procedures are concentrated in a few geographic centers.[4]

In 1968 the method of the late Sir John Charnley for total hip replacement[5] was introduced in Manitoba. In Canada there were no restrictions on the use of methyl methacrylate cement (in contrast to those introduced by the Food and Drug Administration in the United States in the early 1970s); hence the procedure spread rapidly thereafter.

This paper will focus on the impact of centralization of hip replacement in Manitoba. This Canadian province has a population of one million people, spread across an area approximately the size of Alaska. However, half the population and all of the orthopedic surgeons* (as well as most other specialists) are concentrated in the two cities of Winnipeg (population of 500,000 and site of the medical school) and Brandon (population of 36,000).

Northern Manitoba patients who are referred by doctors to Winnipeg or Brandon for specialists' services are insured for travel costs by the provincial government, which also covers the costs of hospital care and nearly all medical fees. Benefits are also available for out-of-province referrals when a physician deems necessary a procedure which cannot be carried out in Manitoba. Although there was some attempt initially to broaden the practice of total hip replacement outside the two tertiary care centers, this practice was discouraged after review by the College of Physicians and Surgeons, the body responsible for quality of care in the province. This policy appears to have achieved the quality goal of centralization. Post operative mortality rates in Manitoba hospitals were low (1.1 per cent) and identical to those achieved in US high-volume hospitals over the same period (1974–75).**

This paper will analyze how the centralization of total hip replacement has affected access to this procedure among provincial residents. Access will be judged by examining age- and sex-adjusted surgical rates across regions. This is the method typically used to estimate community need for total hip replacement.[8,9] Regions with high adjusted rates (indicating higher than expected rates given provincial averages) will be judged as having better access to hip replacement than will regions with lower rates. Access during the early years when this procedure was first performed and access among residents of the relatively isolated northern region of the province are of particular interest.

Age-specific rates by region will also be examined, since indications for the procedure among the very young as well as the very elderly are somewhat more controversial. Gustilo and Burnham[10] point out that loosening of the prosthesis occurs four times more commonly in those under 40 years of age than those over age 60, and risks of operative mortality are significantly greater in the very elderly. Access for these age groups might be particularly restricted among residents distant from the regional care centers. The more general question of the impact of a centralization policy on restriction of access will also be addressed.

Methods

In Manitoba, all medical and hospital care with a few minor exceptions (such as cosmetic surgery) costs nothing to the patient and there is no usage limitation. A complete history of hospitalizations and surgery can be reconstructed for individuals from claims data. Since out-of-province medical care is reimbursable by the Manitoba Health Services

*In 1973 there were 27 orthopedic surgeons practicing in Manitoba and by 1979 there were 31, all certified specialists. The Manitoba supply is approximately 2.7 per 100,000 population, somewhat lower than the United States supply of 4.9 per 100,000 in 1978 (although this figure includes noncertified specialists). If we assume the same per cent board certified as in Rhode Island,[6] the US supply is 3.6 per 100,000 population.[7].

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**This comparison is difficult to make because the Manitoba figures are based on small numbers (278 cases) and the mortality rate was declining over this period; the 1973-74 death rate was 2.0 per cent compared to a 1975-76 rate of .9 per cent. The rates reported above and the Luft, *et al*,[1] rates are based on deaths which occurred in the hospital where surgery took place. However, in Manitoba (as undoubtedly in the US hospitals) patients who developed difficulties are sometimes transferred to another hospital. If deaths following such transfers are included in the Manitoba rates, the mortality rate reported in the text would be 1.8 per cent. No equivalent data are available for the US hospitals.

TABLE 1—Characteristics of Manitoba's Eight Regions

	Winnipeg	Brandon	Western Manitoba	Central Manitoba	Eastern Manitoba	Interlake	Parkland	North
Total Population	557,910	39,490	83,805	74,940	43,925	52,425	51,630	47,940
Population with English Mother Tongue (%)	70.2	86.5	79.3	54.9	36.2	68.2	60.3	75.2
Mean Years of Education	11.0	10.7	10.1	9.7	9.3	9.8	9.4	10.7
Mean Household Income	9,366	8,344	5,526	6,279	6,461	6,644	5,371	11,093
Hospital Beds per 1000 Population	4.8	5.5	7.0	6.1	4.7	4.1	7.1	8.4

SOURCE: Statistics Canada 1971 and 1977 Census Tables by Municipality.

Commission, and since physicians operate under a fee-for-service system, there is an incentive to both physician and patient to claim for each procedure. The reliability and validity of the Manitoba claims data have been investigated extensively.[11–13] This analysis identified all total hip replacements (1,889) performed on patients ages 25 and older over the period 1973 through 1978.

For this paper the province has been divided into eight regions approximating those used by the provincial Department of Health for health services planning purposes (Table 1). Northern Manitoba covers over half the geographic area of the province with many of its residents employed in a few mining communities and earning relatively large cash incomes. Regional surgical rates were based on the patients' place of residence at the time of the surgery, regardless of where the surgery took place. Except where indicated otherwise, rates have been age- and sex-adjusted using the direct method, with the population of Manitoba taken as the standard, following the method suggested by Fleiss.[14] Age-specific rates when calculated are adjusted for sex. Overall differences in percentages across age- and sex-stratified groups were assessed using the Mantel/Haenszel chi square test. Population data were obtained from the Manitoba Health Services Commission Population Registry. Excluded from this analysis are Treaty Indians (2.4 per cent of the Manitoba adult population in 1974) as the Federal Government of Canada is responsible for health care of this group.

Results

Figure 1 indicates that the number of total hip replacements performed in the province was increasing between 1973 and 1977, but their performance remained concentrated in six hospitals in Winnipeg and one in Brandon (where the procedure was introduced in 1975).

Table 2 presents the age- and sex-adjusted rates per 100,000 population 25 years and older for Manitoba's eight regions. The regions have been arranged with Winnipeg and Brandon, those centers in which the surgery is actually performed, on the left hand side of the table, and the most distant regions on the right. The variations in surgical rates across regions show no relation to geographical distance from the surgical referral centers. No consistent pattern in access by different age groups across the regions was found. Age-specific surgical rates (adjusted for sex) for those age 75 and older, and those younger than age 50, are no higher in the referral centers of Winnipeg and Brandon than those in other regions.

Table 3 presents the relative availability of total hip replacement in the referral center regions versus elsewhere broken down by two year intervals beginning with 1973 and 1974. During the earliest years of total hip replacement surgery, older residents of the referral centers may have had slightly better access to care, but in subsequent years, referral center residents appear to have had about the same access to the procedure as did more distant residents.

The final question of interest is, "Does centralization depress the overall rate of performance of total hip replacement within the population?" Manpower and bed constraints in the referral center might restrict access, where in a noncentralized situation, beds and surgical manpower might be more generally available. In Olmstead County, Minnesota, site of the Mayo Clinic,[9] the rate of hip replacement (52.6 per 100,000 residents—age adjusted to the Manitoba population)*** was almost twice as high over the period 1977 through 1980 as was Manitoba's rate (26.8 per 100,000 population). However, it is not clear that centralization can be implicated in Manitoba's low rate. Melton, *et al*,[9] estimate that Olmstead County's rates are also 1.7 to 2.1 times as high as US rates generally, where no policy of centraliza-

***Olmstead County rates, as Manitoba rates, were based only on local residents' surgery, thus excluding the Mayo Clinic's large referral practice.

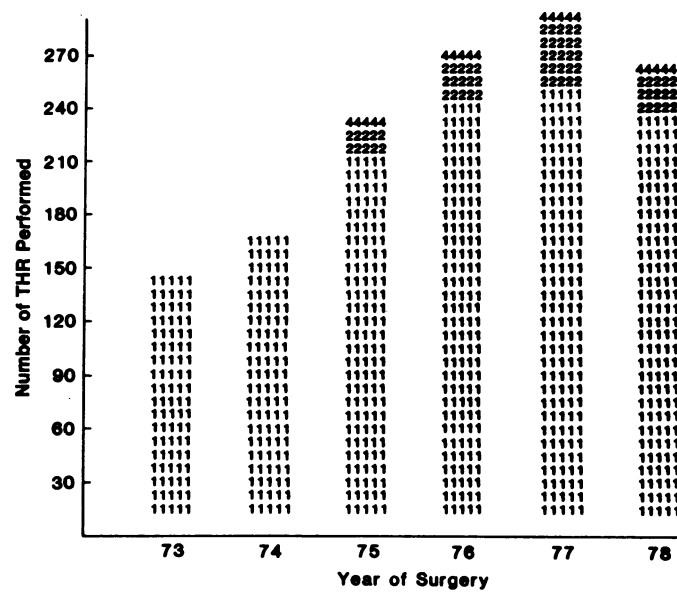

FIGURE 1—Number of Total Hip Replacements Performed by Where Surgery Took Place, Manitoba, 1973–78

TABLE 2—Rates for Total Hip Replacement (THR) by Province, 1973–78

	Winnipeg	Brandon	Western Manitoba	Central Manitoba	Eastern Manitoba	Interlake	Parkland	North
Regional age- and sex-adjusted THR rate per 100,000 population 25 years and older	243.6	258.2	276.8	251.8	165.2	290.7	197.1	209.0
Regional age specific rates (adjusted for sex)								
25–49 years	15.7	22.2	10.6	18.5	6.5	24.7	21.7	18.5
50–64 years	82.2	54.5	96.7	99.1	43.3	102.7	58.2	46.2
65–74 years	86.1	100.7	104.0	72.2	79.5	116.1	79.7	67.1
75 years and older	59.6	80.8	65.5	62.0	35.9	47.2	37.5	77.2
Number of cases	781	60	168	112	42	85	68	23

tion is operating. Massachusetts data show total hip replacement rates similar to those in Manitoba: 29 per 100,000 in 1980.[15]

Discussion

Estimating the potential demand for hip replacement in a given region would ideally require information on a variety of characteristics, including the prevalence of rheumatoid and osteoarthritis, the presence of other coexisting disease or frailty which might contraindicate surgery, and the ability of local physicians to recognize the need for such procedures. However, most attempts to estimate community need for total hip replacement have relied upon simple projections based upon age and sex characteristics of the population in question.[8,9]

Age and sex adjustment could not control the possible selective movement of disabled elderly. However, the most likely direction of such movemement would be from rural areas to urban centers, producing a bias in the opposite direction from these findings. While this may take place in Manitoba, government policy has emphasized the building of nursing homes outside the referral centers of Winnipeg and Brandon. During the period under examination, the distribution of nursing home beds per person age 65 and over did not differ between the referral centers and the rural regions.

Our data have demonstrated that centralization of a procedure such as total hip replacement need not jeopardize residents' access to treatment, even in a province characterized by long distance travel. Centralization has also probably not restricted the overall rate of performing total hip replacement.

The explicit policies of both the Canadian and Manitoban governments to ensure access to health care among citizens of remote regions may have contributed to the success of centralization. In addition to paying for travel, postgraduate students and family practice residents at the University of Manitoba rotate through small hospitals in remote communities; the University of Manitoba supports continuing medical education with specialists often combining attending a remote clinic with a short educational seminar with the local medical staff. Finally, total hip replacement may be especially amenable to centralization. The indications are those of a chronic disease, and rapid communications are not essential for adequate referral. The pattern may differ in the management of other conditions such as aortic aneurysm.

TABLE 3—Total Hip Replacement Rates in the Referral Center Regions (Winnipeg and Brandon) vs Rates in all Other Regions, 1973–74/1975–76/1977–78

	Years of Surgery					
	1973–74		1975–76		1977–78	
	Winnipeg	Elsewhere	Winnipeg/ Brandon	Elsewhere	Winnipeg/ Brandon	Elsewhere
Combined regional age and sex-adjusted THR rates per 100,000 population 25 years+	59.0	51.0	86.0	86.3	93.9	97.1
Combined regional age-specific THR rates (adjusted for sex)						
25–49 years	3.1	3.5	5.8	5.6	6.6	6.6
50–64 years	16.1	17.2	25.8	31.6	35.9	30.5
65–74 years	22.5	18.7	29.7	28.5	32.8	39.7
75 years and older	17.2	11.6	24.8	20.7	18.5	20.3

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What Are the Geneva Conventions?

The Geneva Conventions are international treaties designed for protection of victims of war, including wounded and sick military personnel, prisoners of war, and the civilian population in areas of conflict.

The Geneva Conventions were the outgrowth of a plan proposed by Henry Dunant, a Swiss Businessman, who was shocked by the pitiable condition of the wounded soldiers he saw on the battlefield at Solferino, Italy, in 1859. This plan resulted in the forming of a Committee of Five, a forerunner of the International Committee of the Red Cross, and in the drafting of the First Geneva Convention of 1864, a pact extending the principle of fair and humane treatment to the wounded and sick military personnel in land war.

Between 1864 and 1949, other conventions were ratified by participating nations, including the Second Convention, 1907, which established rules for the protection of armed forces wounded at sea, and the Third Convention, 1929, which provided for the protection of prisoners of war. In 1949, the three existing Conventions were revised, and a Fourth, for the protection of civilians in time of war, was added. Two additional Protocols to the Geneva Conventions of 1949 were adopted by the Diplomatic Conference of Governments in 1977. The first reaffirms and expands the rule for the protection of war victims, especially the civilian population, and the second supplements and develops the rule of protection for victims of noninternational armed conflict. The International Committee of the Red Cross is the all-Swiss group of some 25 citizens that serve as a neutral intermediary between belligerent countries in carrying out the terms of the Conventions. The four Geneva Conventions of 1949 have been translated into 30 languages and place specific obligations on the more than 140 governments that have ratified them.

Provisions Common to All Four Geneva Conventions, Including the Two Protocols of 1977

The Conventions shall apply in all cases of war or armed conflict, even if a state of war is not recognized by one of the belligerents. Persons taking no active part in the hostilities or those placed *hors de combat* (out of combat) by sickness, wounds, detention, or for any other cause, shall, in all circumstances, be treated humanely, without distinction as to race, color, religion or faith, sex, birth or wealth, or any other similar criteria.

Violence to life and person, the taking of hostages, and outrages on personal dignity are strictly forbidden.

Protecting powers shall be designated to safeguard the interests of the victims of international armed conflict and, through the 1977 Protocol, noninternational armed conflict. The International Committee of the Red Cross may be asked to assume the humanitarian functions in the absence of protecting powers.